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ABSTRACT

The computerization of school bus maintenance records by the Niskayuna (New York) Central School District enabled the district's transportation department to engage in management practices resulting in significant savings. The district obtains computer analyses of the work performed on all vehicles, including time spent, parts, labor, costs, numbers of repairs, and numbers and times of visits to maintenance facilities. The system enables the department to address recurrent problems, identify vehicles in need of replacement, analyze vehicle usage patterns that can be altered to extend vehicle life, and monitor fuel consumption effectively. The program has decreased the number of repair visits, increased staff awareness of efforts to economize, improved efficiency, and reduced staffing needs. Samples of the forms used in the program are provided and tables displaying data on the program are appended. (PGD)

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COMPUTERIZED FLEET MAINTENANCE

John J. Cataldo
Assistant Superintendent for Business
Niskayuna Central School District
September 1985
ASBO 85

Niskayuna Central School District is located in a suburban community on the eastern side of Schenectady. The district encompasses portions of three counties; Albany, Saratoga, and Schenectady. The Transportation Department provides daily service for 3,600 students to 41 buildings. This department provides an entire spectrum of services to groups such as severally handicapped students, private and parochial students, district and community athletic activities, etc. The 1984-85 transportation budget totaled $992,466 with $158,140 authorized for the replacement of five vehicles.

During the 1980-81 and 1981-82 school years the district was aggressively reexaming major program departments by independent consultants. Mr. James Thompson, Transportation Director, and Mr. Herbert Levack, Head Mechanic, recommended Mark L. Barie, Transportation Management Consultant in June of 1981 on an experimental trial basis. The above individuals are the nucleus that established and maintained the computerized fleet maintenance program.

The program can be divided into three component areas; first, Garage Operations; second, vehicle replacement; third, fuel consumption.

The garage operation established a detailed coding system of all work performed as well as the identification of the time required to perform the repair. Once the service is completed the cost of the parts and labor is computed for the visit. At the conclusion of each month, the district currently sends these forms to the service bureau which in return submits a computer generated analysis. The district is in the process of purchasing its own hardware and software to perform this service in house and eliminate this on going cost. The monthly report identifies by vehicle all maintenance costs by major categories. Our categories are divided as follows:

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Body
Brake
Electric
Steering
Engine
Transmission
Drive
Wheel
Chassis
Miscellaneous

These major categories have been sub-divided to identify over 100 repair items. The individual vehicle reports are then summarized for the entire fleet. Upon receiving the monthly report, the Director of Transportation completes a calculation that provides key factors to determine the effectiveness of our maintenance program.

1. PM's to EM's Ratio. This is the number of preventative maintenance visits divided by the number of emergency maintenance visits. A ratio of 2 to 1 is good.

2. Repairs per Vehicle. To compute this figure, divide the total number of repairs by the number of vehicles which came into the garage.

3. Repairs per visit. This represents the repairs that are made to a vehicle per visit. The increased number of repairs during each visit demonstrates the effectiveness of the preventative maintenance program and also points to increased efficiency.

4. Cost per repair. The total cost of labor and parts divided by the number of repairs.

5. Monthly cost per vehicle. Divide the monthly costs by the number of vehicle visits to the garage. Any observable trend with this figure is significant. Fleet age grouping may also be beneficial considering this analysis.

6. Hours per man-day. This represents the total number of hours logged, divided by the total number of actual days worked. Typically 4 to 5 hours per man per day are logged.

After these computations are completed, the variations to prior reports are explored. High expenditures are reviewed to determine the cause. The use of Computerized Fleet Maintenance allows the examination of specific repairs, their frequency of occurrence and the effectiveness of each repair. Based on this analysis, the Director of Transportation can make recommendations concerning remediation of the problem areas such as retraining, lack of spare buses, and abuse of vehicles, etc.

The second significant use of the "CFM" report is the rationale for vehicle replacement. The district traditionally sought voter approval for school bus replacement as a separate proposition. In addition with the increasing time requirements for delivery of school buses the proposition was moved earlier in the school year separate from the budget vote. The detailed analysis provided by "CFM" greatly increased our creditability with the community, thereby significantly improving our fleet age. The criteria that we analyzed to determine which buses should be replaced is as follows:

1. Age of vehicles
2. Mileage of vehicles
3. Total maintenance cost
4. Total cost per mile
5. Vehicles ranked by current useage
6. Labor hours per bus
7. Repairs per bus
8. Ratio of PM's to EM's
9. Ranking by age and repair category

In addition to the obvious benefits, the bus replacement report has focused our attention to specific useage patterns of the fleet. Based on this review the Transportation Director has been able to change patterns which will extend the life of vehicles as well as to avoid a replacement program with large peaks and valleys due to random useage patterns. Also, the school bus replacement report is derived directly from "CFM" thus no additional data is required.

The third significant use of the "CFM" report is the monitoring of fuel consumption. Drivers fill out a daily form identifying the total number of gallons fueled per vehicle.

These forms are submitted monthly to the service bureau and a fuel consumption report is generated. The report identifies by vehicle the starting and ending odometer readings. The report includes the monthly gallons supplied, the miles per gallon, plus the year to date totals. In addition, average "mpg" is computed with the best and worst performers identified.

The Director of Transportation posts vehicle performance as a reminder to drivers of their results. He not only uses this as a topic in his driver's meetings but also discussing with drivers their own performance levels. Driver motivation and training is a key variable for continued "mpg" improvement.

Through the use of "CFM" the district has heightened the awareness of the entire transportation staff . The district has reaped the benefits of this program with increased utilization of available resources to minimize or offset cost increases. The September 1983 to April 1984 Annual Report identified significant areas of accomplishments:

1. The number of total visits and unexpected visits to the garage reduced 37% and 44% respectively.

2. The total logged costs and cost per vehicle has reduced 7% and 1% respectively.

3. A measure of productivity and efficiency can be found in the repairs per visit figure. The total repairs to visits increased 41%. This reflects that all necessary repairs are performed prior to the actual breakdown resulting in fewer visits and ultimately in fewer repairs.

4. The M.P.G. ratings improved for identical vehicles by 6% to 7-1/2%.

In addition to these results the district was able to reduce .5 mechanic position or 12.5% labor reduction.

If I can be of further assistance please contact me at 518-377-4070.

JJC:KA
1/8/85

PART I GARAGE OPERATIONS

DATE SERVICE DUE _____

NISKAYUNA CENTRAL SCHOOLS — WORK ORDER FORM — BUS GARAGE

VEHICLE # 13 — MILEAGE: 82,958 — REPAIR ORDER WRITTEN BY: — DATE IN SHOP: 9-18-85

CHASSIS NO.: — MODEL YEAR: — CAPACITY: — MECHANIC: J. HABER — DATE COMPLETED: 9-18-85

TYPE OF REPAIR (CHECK ONLY ONE) — PREVENTATIVE MAINTENANCE ( ) OR EMERGENCY MAINTENANCE ( )

WRITE INSTRUCTIONS BELOW	INDICATE WORK COMPLETED	PART #	MECHANIC INITIAL & HRS.	PARTS $	LABOR $
	CHANGED LRI				
	TIRE				
	1 NEW CAP	900X20	J.H. 1/2	$70.00	
7					
					8

BUS NO.____ MODEL____YEAR____ BODY_____PREVENT.MAINT._____

MILEAGE_____ DATE ____MECHANIC_____EMERG.REPAIR_____

(3CHARACTERS) (4 CHAR.)
NEAREST $

ENGINE 500	PARTS	LABOR
510 TUNE UP		
520 MOTOR MOUNTS		
525 GAS LINE FILTERS		
530 CARB		
535FUEL PUMP		
540 BELTS		
550 RADIATOR		
560 WATER PUMP		
565 ENGINE HEATERS		
570 OIL		
575 INJECTOR PUMP		
580 ANALIZER		
590 EMISSION TEST		
599 MISC. ENG.		

COMPARISON OF PREVENTIVE TO EMERGENCY VISITS

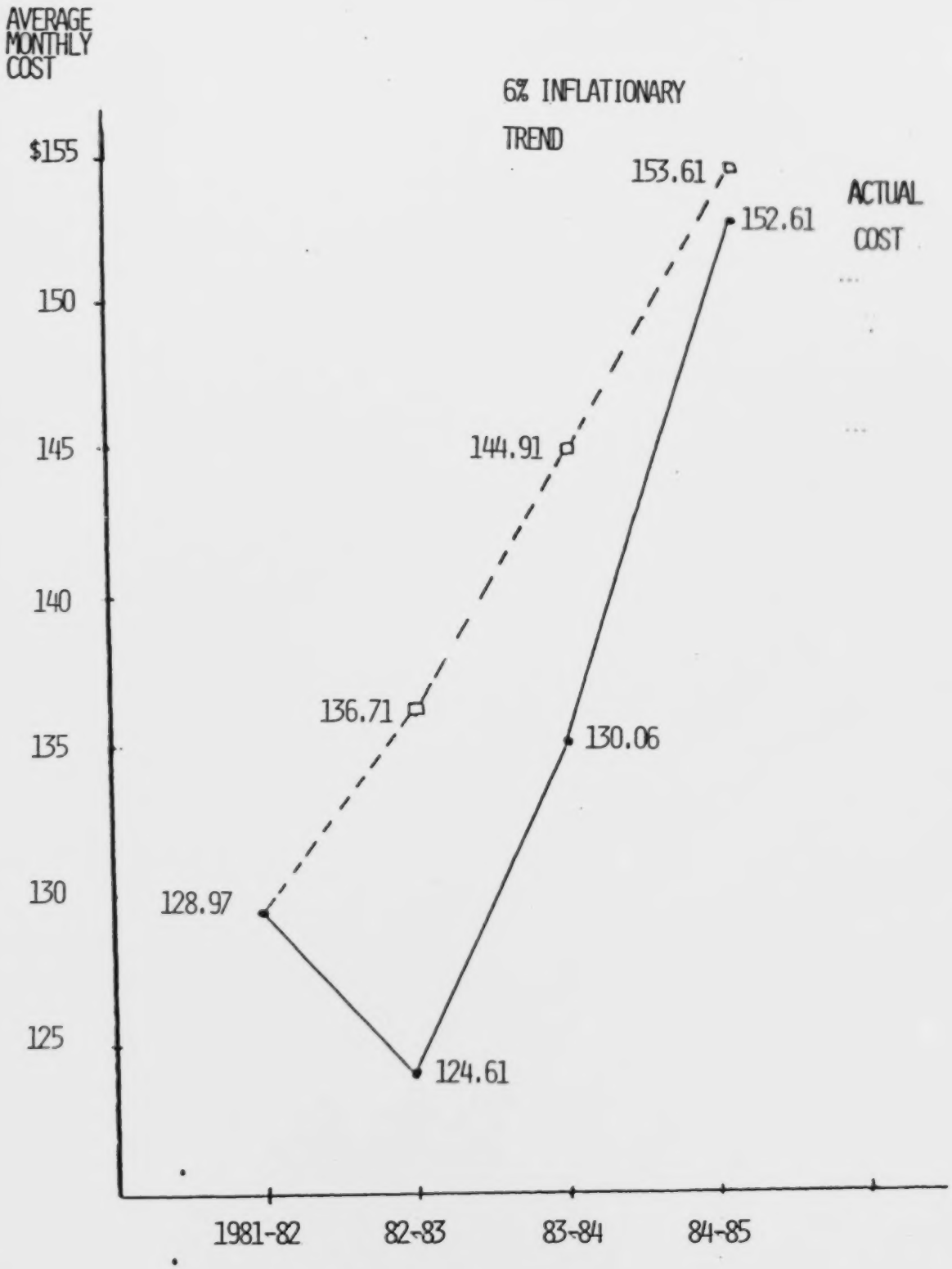
	1981-82	1982-83	1983-84	1984-85
# OF VISITS	1765	1480	1037	1004
PM VISITS	977	895	657	540
EM VISITS	788	585	380	464

EACH TIME A BUS VISITS THE GARAGE FOR REPAIRS, MONIES ARE EXPENDED; FOR PARTS AND LABOR. ONE GOAL IS TO REDUCE THE NUMBER OF UNEXPECTED VISITS AND THE NUMBER OF TOTAL VISITS.

ANALYSIS OF TOTAL REPAIRS AND REPAIRS PER VEHICLE PER VISIT

	1981-82	1982-83	1983-84	1984-85
TOTAL VISITS	1765	1480	1037	1004
# REPAIRS PER VISIT	1.54	1.89	2.42	2.43
TOTAL # OF REPAIRS	2796	2771	2514	2441

THE NUMBER OF REPAIRS IS AN IMPORTANT INDICATOR OF EFFICIENCY, COST AND EFFECTIVENESS.



TREND ANALYSIS OF AVERAGE COST PER VEHICLE PER MONTH VERSUS 6% INFLATIONARY INCREASES

PART II VEHICLE REPLACEMENT PROGRAM

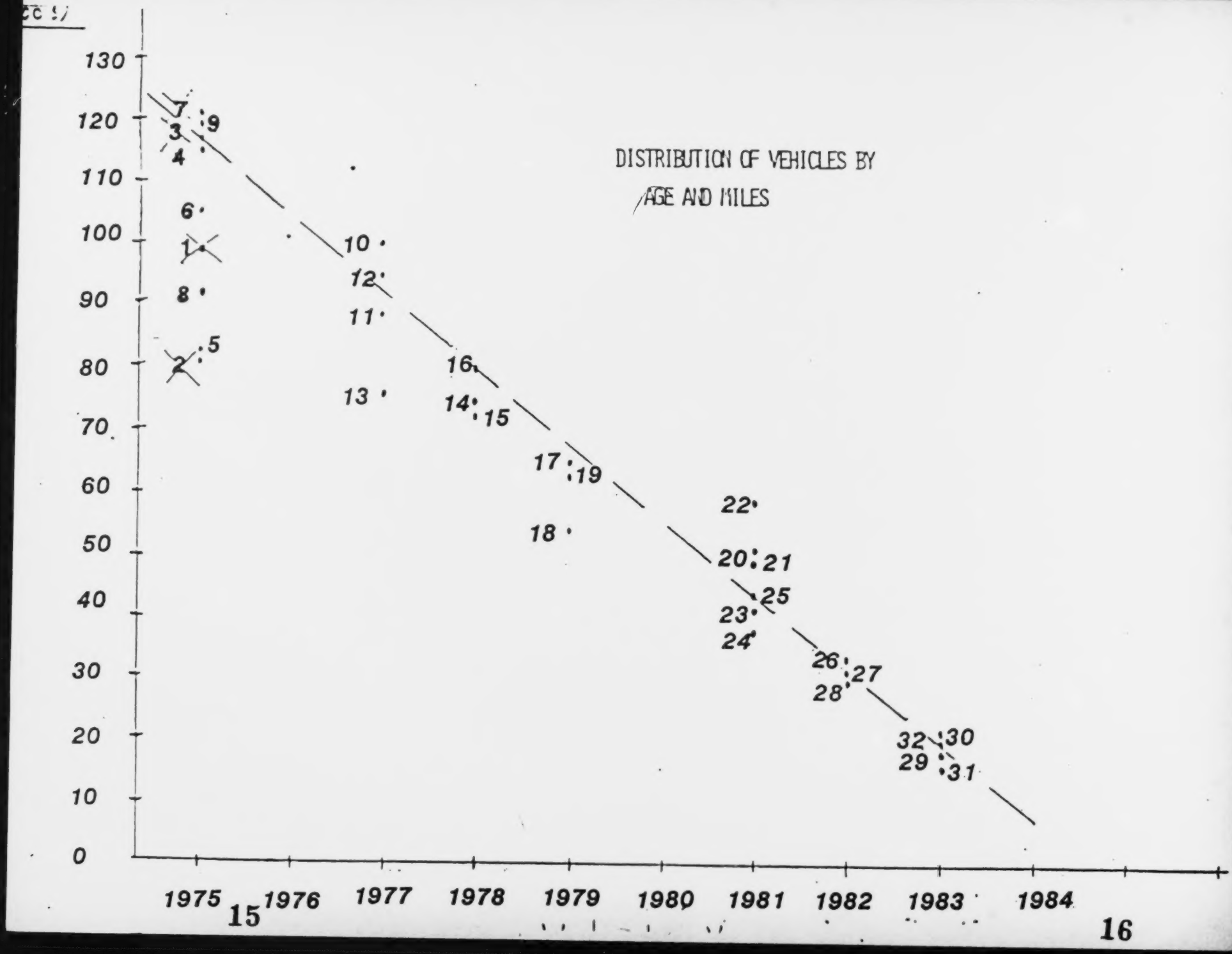

DISTRIBUTION OF VEHICLES BY
AGE AND MILES
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
15
16

EXHIBIT II

NISKAYUNA CENTRAL SCHOOL DISTRICT

LARGE PASSENGER VEHICLES
BY MILEAGE*

Vehicle No.	Mileage	Year
9	116,973	1975
4	115,942	1975
6	105,583	1975
10	100,388	1977
12	94,986	1977
8	92,053	1975
11	88,275	1977
5	81,651	1975
16	80,418	1978
13	75,925	1977
14	75,098	1978
15	73,635	1978
17	65,651	1979

Only those vehicles with greater than 65,000 miles as of October 31, 1984.

VEHICLES RANKED BY 1983-84 MILEAGE*

Vehicle No.	Year	1983-84 Mileage
4	1975	10,333
12	1977	10,163
6	1975	10,148
16	1978	9,238
9	1975	8,965
10	1977	8,728
11	1977	7,901
8	1975	7,727
15	1978	7,661
5	1975	7,574
14	1978	7,289
13	1977	6,739
17	1979	4,965
Ave.		8,094

* Useage from 11/83 to 10/84

VEHICLES RANKED BY COST PER MILE*

Vehicle No.	Cost per Mile	Total Cost
17	39.4¢	$1,958.33
11	36.5¢	$2,883.56
10	28.4¢	$2,480.20
14	25.5¢	$1,864.50
9	16.6¢	$1,494.06
6	16.4¢	$1,665.13
16	15.8¢	$1,458.12
5	14.5¢	$1,102.49
8	14.2¢	$1,098.81
13	11.2¢	$759.79
15	10.5¢	$811.39
12	10.4¢	$1,060.33
4	7.7¢	$799.41
Ave.	19.0¢	

* Based on figures from 11/83 to 10/84

LABOR HOURS PER BUS

REPAIRS PER BUS

	TOTAL HOURS	# OF BUSES	HOURS PER BUS	# OF REPAIRS	AVE. # OF REPAIRS PER BUS
1971's	98.9 hrs.	4	24.68	67	16.75
1972's	94.9 hrs.	3	31.63	63	31.0
1974's	142.9 hrs.	5	28.58	132	26.40
1975's	182.1 hrs.	8	22.76	162	20.25
TOTAL	518.8 hrs.	20	25.94	424	21.20
FLEET	1360.30	58*	23.45*	959*	16.53*

*includes all vehicles

1975 VEHICLES ACCORDING TO RANK

Vehicle No.	Y.T.D. Mileage	PM-EM Ratio	Cost Per Mile	Rank Totals	Final Rank
4	2	3	1	6	1
5	5	2	3	10	3
6	3	4	4	11	4
8	4	1	2	7	2
9	1	5	5	11	4

VEHICLES RANKED BY RATIO OF PM TO EM VISITS

Vehicle	Total Visits	No. of P.M. Visits	No. of E.M. Visits	P.M.-E.M. Ratio
8	18	13	5	.86
5	31	15	16	.94
13	34	17	17	1.00
10	27	14	13	1.07
11	27	15	12	1.25
4	29	17	12	1.42
6	25	15	10	1.50
16	23	14	9	1.55
14	21	13	8	1.62
15	30	19	11	1.73
9	28	18	10	1.80
12	23	15	8	1.87
17	26	18	8	2.25
Ave.				1.45

RANKING BY AGE AND REPAIR CATEGORY

YEAR	MISC.	BODY	BRAKE	ELEC.	STEER.	ENGINE.	TRANS.	DRIVE	WHEEL	CHASSIS	AVERAGE RANKING
1975	3	-	-	4	-	-	1	-	4	-	3
1974	5	2	-	-	-	-	-	-	-	3	3.3
1972	1	-	3	-	4	3	-	-	-	3	2.8
1971	-	-	-	-	3	-	-	-	-	2.5	2.75

PART III FUEL CONSUMPTION ANALYSIS

FULL USAGE REPORT

MONTH: JUNE 1985

BUS	YEAR	MFG	BODY	SZ	ODOMETER START	ODOMETER END	JUN GAL	JUN MPG
3	1975	INTL	NONE	66	120183	120653	68	6.9
4	1975	INTL	NONE	66	118504	118757	83	[3.1]
5	1975	INTL	NONE	66	88254	88978	168	4.3
6	1975	INTL	NONE	66	111213	111920	151	4.7
8	1975	INTL	NONE	66	98410	109920	128	89.9
9	1975	INTL	NONE	66	124465	125427	285	[3.4]
10	1977	INTL	NONE	66	108635	109302	131	5.1
11	1977	INTL	NONE	66	94188	94954	128	6.0
12	1977	INTL	NONE	66	102090	103056	214	4.5 [
13	1977	INTL	NONE	66	81895	82459	110	5.1
14	1978	INTL	NONE	65	80413	80860	84	5.3 [
15	1978	INTL	NONE	65	76647	77044	87	4.6
16	1978	INTL	NONE	65	86658	87321	164	[4.0]
17	1979	INTL	NONE	66	73084	73748	187	[3.5][
18	1979	INTL	NONE	66	59451	59713	49	5.3
20	1981	INTL	NONE	66	61329	62417	148	7.4
21	1981	INTL	NONE	66	56417	57050	97	6.5
22	1981	INTL	NONE	66	67539	68363	125	6.6
23	1981	INTL	NONE	66	54016	55261	140	8.9
24	1981	INTL	NONE	66	46665	47747	130	8.3
25	1981	INTL	NONE	66	48579	49123	64	8.5
26	1982	INTL	THOM	66	44599	45757	148	7.8
27	1982	INTL	THOM	66	44169	45036	139	6.2
28	1982	INTL	THOM	66	38817	39510	95	7.3
29	1983	INTL	THOM	66	29651	30783	135	8.4
30	1983	INTL	THOM	66	32597	33772	154	7.6
31	1983	INTL	THOM	66	26268	27272	144	7.0
32	1983	INTL	THOM	66	29940	31040	120	9.2
33	1984	INTL	THOM	66	2933	3588	51	12.8
34	1984	INTL	THOM	66	5196	6169	99	9.8
35	1984	INTL	THOM	66	6322	7565	135	9.2
36	1984	INTL	THOM	66	4770	5680	138	6.6
83	1979	INTL	NONE	20	86161	87266	191	5.8
84	1979	INTL	NONE	30	77918	78242	57	5.7
85	1980	CHEV	NONE	16	88401	89201	106	7.5
86	1981	INTL	NONE	20	56443	57611	180	6.5
87	1982	INTL	THOM	30	58445	59956	144	10.5
88	1982	INTL	THOM	30	42636	43293	62	10.6
89	1982	CHEV	THOM	30	34852	36120	139	9.1
90	1984	CHEV	THOM	22	11769	12613	72	11.8
101	1983	CHEV	SUBRBN	7	54918	56951	161	12.6

TOTAL MILEAGES
GALLONS
M.P.G.

BEST COPY AVAILABLE

SIZE RANGE USED FOR STATISTICAL COMPARISONS 36 TO 72
AVERAGE MPG FOR THIS MONTH IS 5.6
BEST PERFORMERS HAVE MPG'S ABOVE 7.0
WORST PERFORMERS HAVE MPG'S BELOW 4.2
TOTAL MILES FOR THE YEAR IS 475681
TOTAL GALLONS FOR THE YEAR IS 75684

MILES PER GALLON ENTIRE FLEET

MONTH	82-83	83-84	84-85
9	5.0	5.0	5.2
10	4.9	5.3	5.3
11	4.7	4.9	5.1
12	4.8	5.3	4.9
1	4.7	5.0	4.9
2	4.9	5.1	4.8
3	5.0	5.0	5.6
4	4.7	5.4	5.2
5	5.3	5.6	5.4
6	5.4	5.2	5.6
TOTAL MILES	453.443	444.831	475.681
TOTAL GALLONS	83,440	75,501	75,684
FLEET AVERAGE	5.43	5.89	6.28